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User's Guides to the Interactive Version of Three Point Source Dispersion Programs PTMAX, PTDIS, and PTMTP

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Research Triangle Park, NC

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16. Abstract (Limit: 200 words)

This document covers the PTMAX which is an interactive program which performs an analysis of the maxium, short-term concentration from apoint source as a function of stability and wind speed. PTDIS is an interactive program which computes short-term concentrations downwind from a point source at distances specified by the user. PTMTP is an interactive program which computes, at multiple receptors, short term concentrations resulting from multiple point siurces.

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Users' Guides to the Interactive Versions of Three Point Source Dispersion Programs: PTMAX, PTDIS, and PTMTP

by

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and

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Program Element 21ADN

Notice

This document is a preliminary draft. It has not been formally released by EPA and should not at this stage be construed to represent Agency policy. It is being circulated for comment on its technical accuracy and policy implications.

NATIONAL ENVIRONMENTAL RESEARCH CENTER
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RESEARCH TRIANGLE PARK, N. C. 27711

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*On Assignment from the National Oceanic & Atmospheric Administration, U.S. Department of Commerce

Three steady-state Gaussian plume point source models have recently been added to EPA's UNAMAP (Users' Network for Applied Modeling of Air Pollution) and to the UNAMAP system available to non-EPA users.

EPA users access UNAMAP models by entering "UNAMAP" as the procedure name at log on. Non-EPA users may obtain information as to access to UNAMAP models by contacting Mr. Peter Loux, Computer Sciences Corporation, 1701 North Fort Meyer Drive, Arlington, Va. 22209. Phone (703) 527-6080. On both systems the command "UNAMAP" after log on is accomplished, produces a brief description of each model currently available.

Each of the three programs is briefly described including a program abstract for each program.

```
READY
unamap
 'TSO.UNAMAP(CATAL)'
UNAMAP- Users Network for Applied Modeling of Air Pollution

Contact:     Dr. Ron Ruff, Chief, Computer Techniques Group
             Division of Meteorology
             Environmental Protection Agency
             Research Triangle Park, North Carolina  27711
             Phone 919/549-4566

CATALOG OF PROGRAMS as of 06/01/73

APRAC - A short-term Urban Diffusion Model that calculates the
        automotive contribution to Carbon Monoxide.  The model
        was developed by Stanford Research Institute (SRI).
        A 120 page manual is available on the model.

HIWAY - A model that calculates a pollutant concentration
        in the vicinity of a roadway.  The model is
        self-documenting.

PTMAX - An interactive program which performs an analysis of
        the maximum, short-term concentration from a point
        source as a function of stability and wind speed.

PTDIS - An interactive program which computes short-term
        concentrations downwind from a point source at
        distances specified by the user.

PTMTP - An interactive program which computes, at multiple
        receptors, short term concentrations resulting from
        multiple point sources.
```

Users' Guide to PTMAX (the Interactive Version of DBT 52)

Program Abstract

PTMAX produces an analysis of maximum concentration as the function of wind speed and stability. A separate analysis is made for each individual stack. Input to the program consists of ambient air temperature, and characteristics of the source, such as emission rate, physical stack height, and stack gas temperature. Either the stack gas volume flow or both the stack gas velocity and inside diameter at the top are also required. Outputs of the program consist of effective height of emission, maximum ground level concentration, and distance of maximum concentration for each condition of stability and wind speed.

This program determines for each wind speed and stability the final plume rise using methods suggested by Briggs. This plume rise is added to the physical stack height to determine the effective height of emission. The effective height is used to determine both the maximum concentration and the distance to maximum concentration.

The following assumptions are made: a steady-state Gaussian plume model is applicable to determine ground level concentrations. Computations can be performed according to the "Workbook of Atmospheric Dispersion Estimates." The dispersion parameter values used for the horizontal dispersion coefficient, sigma y, and the vertical dispersion coefficient, sigma z, are those given in Figures 3-2 and 3-3 of the workbook. The stated wind speed occurs at the stack top for dilution of the plume and through the layer that the plume rise occurs. The stated stability occurs from ground level to well above the top of the plume. If there is a limit to vertical mixing, it

occurs far enough above the top of the plume so that it has no influence upon the maximum concentration. There are no topographic obstructions in the vicinity of the source. The source exists in either flat or gently rolling terrain.

Use of this program is applicable where single sources exist in relatively uniform terrain. It is not applicable if aerodynamic downwash around buildings in the vicinity of the source affects the plume emitted from the stack. The calculated concentrations are for the single source considered. Where multiple stacks exist for a given single plant this program can be applied to each individual stack. It cannot give the maximum concentrations of the combination of the stacks however. This program is useful in determining what combinations of wind speed and stability produce maximum concentrations. For a given stability the critical wind velocity, that is, the wind speed that causes the maximum concentration, can be determined. This can be done by seeing which wind speed produces the highest concentration for that stability.

The use of the interactive version of the program is quite simple. An alpha-numeric title is used to put a heading on the output. The ambient air temperature in degrees-K is asked for. If a zero is entered a value of 293 will be used. The stability class is asked for next. If a zero is entered, all stabilities 1 through 6 are considered. Numbers 1 through 6 correspond to stabilities A through F. Source strength of the pollutant considered

in grams per second is asked for next. The physical stack height in meters is then required. The stack gas temperature in degrees-K is next entered. If the volume flow in cubic meters per second is known, it is next entered. If it is not known, a zero is entered, and both stack gas velocity in meters per second, and stack diameter at the top of the stack in meters are required.

The above inputs are then used to perform the calculations and are repeated on the output. The output table is in the form of 5 columns of information: stability, wind speed, maximum concentration, the distance of the maximum concentration, and plume height. The maximum concentration is in grams per cubic meter. The distance of the maximum concentration is in kilometers and the plume height which is final plume height according to Briggs method is in meters. When the table is completed for each stability or the stated stability the program asks for input for a second run, starting with the title. This is repeated until the user wishes to terminate the run. Termination is by entering END when the title is asked for. For second and subsequent runs, parameter values which are to remain unchanged from the preceding run may be entered by using a comma. Concentrations of 9.90 E+01 and distances of 999.000 are indicators that no concentration estimates were attempted. Also numbers in parentheses refer to footnotes. These are printed at the bottom of the first output if they are needed. The user is offered the option of another run starting with a title or concluding the run by typing END.

```
READY
ptmax
ENTER ALPHANUMERIC TITLE OF UP TO 64 CHARACTERS, OR "END".
?
test of ptmax 7/5/73
ENTER AMBIENT AIR TEMPERATURE (DEG K) OR ZERO TO USE DEFAULT VALUE
OF 293.
?
0
ENTER SELECTED STABILITY CLASS OR ZERO (0) FOR ALL STABILITIES
?
0
ENTER SOURCE STRENGTH (G/SEC)
?
287
ENTER PHYSICAL STACK HEIGHT (M)
?
30
ENTER STACK GAS TEMPERATURE (DEG K)
?
350
ENTER VOLUME FLOW (M**3/SEC) IF KNOWN, OR ZERO (0) IF NOT KNOWN
?
0
ENTER STACK GAS VELOCITY (M/SEC)
?
20
ENTER STACK DIAMETER (M)
?
0.6


TEST OF PTMAX 7/5/73
ANALYSIS OF CONCENTRATION AS A FUNCTION OF STABILITY AND WIND SPEED.
1971 VERSION, D. B. TURNER.

EMISSION RATE (G/SEC) =  287.00
PHYSICAL STACK HEIGHT (M) =   30.00
STACK GAS TEMP (DEG K) = 350.00
AMBIENT AIR TEMPERATURE (DEG K) = 293.
STACK GAS VEL (M/SEC) =  20.00
STACK DIAMETER (M) =  0.60
VOLUME FLOW (CU M/SEC) =    5.65
```

STABILITY	WIND SPEED (M/SEC)	MAX CONC (G/CU M)	DIST OF MAX (KM)	PLUME HEIGHT (M)
1	0.5	7.7219E-03	0.486	124.6
1	0.8	7.9789E-03	0.397	89.1
1	1.0	8.0089E-03	0.357	77.3
1	1.5	7.7614E-03	0.297	61.5
1	2.0	7.3243E-03	0.264	53.6
1	2.5	6.8569E-03	0.243	48.9
1	3.0	6.4449E-03	0.229	45.8
2	0.5	5.9313E-03	0.858	124.6
2	0.8	6.8110E-03	0.632	89.1
2	1.0	7.0593E-03	0.555	77.3
2	1.5	7.1534E-03	0.445	61.5
2	2.0	6.9109E-03	0.387	53.6
2	2.5	6.5671E-03	0.352	48.9
2	3.0	6.2193E-03	0.329	45.8
2	4.0	5.5448E-03	0.300	41.8
2	5.0	4.9602E-03	0.283	39.5
3	2.0	6.9162E-03	0.593	53.6
3	2.5	6.6545E-03	0.536	48.9
3	3.0	6.3366E-03	0.498	45.8
3	4.0	5.6913E-03	0.452	41.8
3	5.0	5.1156E-03	0.424	39.5
3	7.0	4.2116E-03	0.392	36.8
3	10.0	3.3027E-03	0.368	34.7
3	12.0	2.8817E-03	0.359	33.9
3	15.0	2.4164E-03	0.350	33.2

4	0.5	2.7076E-03	4.218	124.6
4	0.8	3.8535E-03	2.469	89.1
4	1.0	4.3419E-03	1.978	77.3
4	1.5	5.0153E-03	1.387	61.5
4	2.0	5.2362E-03	1.120	53.6
4	2.5	5.2049E-03	0.980	48.9
4	3.0	5.0042E-03	0.912	45.8
4	4.0	4.5535E-03	0.827	41.8
4	5.0	4.1275E-03	0.777	39.5
4	7.0	3.4331E-03	0.719	36.8
4	10.0	2.7143E-03	0.676	34.7
4	12.0	2.3762E-03	0.660	33.9
4	15.0	1.9993E-03	0.643	33.2
4	20.0	1.5790E-03	0.626	32.4
5	2.0	2.8291E-03	2.547	61.0
5	2.5	2.4885E-03	2.403	58.7
5	3.0	2.2350E-03	2.294	57.0
5	4.0	1.8775E-03	2.139	54.6
5	5.0	1.6334E-03	2.031	52.8
6	2.0	2.4535E-03	4.410	55.7
6	2.5	2.1665E-03	4.120	53.9
6	3.0	1.9514E-03	3.906	52.4
6	4.0	1.6456E-03	3.603	50.4
6	5.0	1.4270E-03	3.434	48.9

ENTER ALPHANUMERIC TITLE OF UP TO 64 CHARACTERS, OR "END".
?
end

Users' Guide to PTDIS (the Interactive Version of DBT 43)

Program Abstract

PTDIS calculates downwind ground-level concentrations for various downwind distances for the input meteorological conditions. Only an individual source can be considered. Inputs to the program consist of information on the source and information on the meteorological conditions to be considered. Primary output of the program consists of a table with height of emission and concentration given for each downwind distance. Also included in this table but not frequently needed are the values of the dispersion parameters sigma y and sigma z for each distance and also a relative concentration normalized for wind speed and source strength commonly called $\chi u/Q$. An optional feature of the program allows the user to enter a value of concentration to be used for the determination of half-width of isopleths. For each distance, if the concentration exceeds the stated isopleth value the half-width of an isopleth will be determined. Also this half-width will be compared in the form of a ratio to the half-width of a sector of given angular size in terms of degrees. The user is also given the option of either specifying effective height of emission or having it calculated using Briggs' plume rise methods.

This program determines the concentration at ground level from a single point source using a steady-state Gaussian model. The computations used are similar to those shown in the Workbook of Atmospheric Dispersion Estimates. The dispersion parameter values are also those given in Figures 3-2 and 3-3 of this Workbook. The concentrations are for a single meteorological condition defined by a stability class using the numbers 1 through 6 to represent the Pasquill stability types A through F. The single wind speed used is assumed to be representative of the top of the stack, as well as through the layer that plume rise occurs. The effect of a

definite limit to vertical dispersion or mixing height is included in the computations. It is assumed that complete eddy reflection occurs at this barrier. It is assumed that the given stability occurs from ground level to the mixing height. The concept of a mixing height is not employed for stabilities 5 or 6. It is assumed that there are no topographic obstructions in the vicinity of the source and that the source is in an area of either flat or gently rolling terrain. No consideration of the possibility of aerodynamic downwash is included.

Given a stability and wind speed condition, this program is useful in obtaining the variation of ground level concentration with distance. Concentratons derived from these calculations can be considered to be valid for averaging times from ten minutes to an hour. The meteorological input must also be valid for these averaging times. Although the computational system will yield numerical values for effective plume heights of above 1,000 meters, any computations performed for plume heights of greater than three or four hundred meters should be considered with a certain amount of skepticism.

The use of the interactive version of this program is quite simple. Some cautionary statements are printed out first indicating where the computations are most valid. The number of distances for which calculations are to be made is entered first.

There is a maximum of 50 distances. After this number of distances has been entered, the distances, in kilometers, are entered separated by commas or spaces. Although the distances can be entered in any order, it is handy in interpreting output if the smallest distances are first and the distances ordered with increasing distance. The user is asked if he wants to use the isopleth option. He can answer yes or no. If he says yes he is asked how many isopleths he wants to consider. There is a maximum of eight. Next, the isopleth values in grams per cubic meter are entered separated by commas and he is also asked to enter a wind segment size in degrees. This is commonly 10° or 22.5°. This is used to compare the isopleth widths at each distance. Whether the isopleth option is used or not, the next variable entered is the stability class, a number from 1 to 6. Next the wind speed in meters per second is entered, and finally the mixing height in meters. This concludes the entries of the meteorological variables. The source strength in grams per second of the pollutant being considered is entered next. If a specific effective height of emission is desired this is entered, in meters. A zero is entered here if the plume rise is to be calculated. The physical stack height in meters is entered. The stack gas temperature in degrees Kelvin is entered. The ambient air temperature in degrees Kelvin is entered. If a zero is used here a value of 293 is used. If the stack gas volume flow, in cubic meters per second, is known it is entered next; if it is

unknown, a zero is entered. If the volume flow was not entered, the stack gas velocity, in meters per second, is next entered and the stack diameter in meters. Outputs consist of a listing of the source conditions, the meteorological conditions, and a table giving distance, effective height, and concentration for each distance. If the isopleth option is used an additional table giving the half-width, and a ratio of the isopleth half-width to the sector half-width for each isopleth value, for each distance. This concludes one run of the program. The user has options as to where he can reenter the program or to conclude the run.

```
 READY
ptdis


* * *  N O T I C E  * * *
USE OF THIS MODEL PRIOR TO JUNE 14, 1973 MAY HAVE PRODUCED ERRONEOUS
RESULTS IF MORE THAN ONE PASS WAS MADE AND A COMMA WAS USED TO DEFINE
MIXING HEIGHT.


DO YOU WANT THE PRECAUTIONARY MESSAGE PRINTED? ENTER YES OR NO
?
yes
   CARE SHOULD BE EXERCISED IN THE INTERPRETATION OF THESE CALCULATED
CONCENTRATIONS.  CONCENTRATION ESTIMATES MAY BE EXPECTED TO BE
WITHIN A FACTOR OF THREE FOR: 1) ALL STABILITIES OR DISTANCES
OF TRAVEL OUT TO A FEW HUNDRED METERS.  2) NEUTRAL TO MODERATELY
UNSTABLE CONDITIONS FOR DISTANCES OUT TO A FEW KILOMETERS.
3) UNSTABLE CONDITIONS IN THE LOWER 1000 METERS OF THE ATMOSPHERE
WITH A MARKED INVERSION ABOVE FOR DISTANCES OUT TO TEN
KILOMETERS OR MORE.  FOR OTHER CONDITIONS THESE ESTIMATES BECOME LESS
RELIABLE FOR EXTREMES OF STABILITY AND AS TRAVEL DISTANCE
INCREASES.


ENTER ALPHANUMERIC TITLE (UP TO 64 CHARACTERS)
?
test of ptdis 7/5/73
ENTER NUMBER OF DISTANCES FOR WHICH CALCULATIONS ARE TO BE
MADE.  MAXIMUM 50
?
22
ENTER DISTANCES (KM) SEPARATED BY COMMAS OR SPACES
?
0.1,0.2,0.3,0.4,0.452,0.5,0.6,0.7,0.8,0.9,1.0,2.,3.,5.,7.,10.,
?
15.,20.,30.,50.,70.,100.
DO YOU WANT THE ISOPLETH OPTION? ENTER YES OR NO
?
yes
ENTER NUMBER OF ISOPLETHS TO BE CONSIDERED.  MAXIMUM 8
?
3
ENTER ISOPLETH VALUES (G/M**3) SEPARATED BY COMMAS OR SPACES
?
1.0e-03,2.0e-4,1.0e-04
ENTER WIND SEGMENT SIZE (DEG)
?
22.5
```

```
ENTER SOURCE STRENGTH (G/SEC)
?
287
ENTER EFFECTIVE HEIGHT OF EMISSION (M) IF YOU WISH OR ENTER ZERO
(0) TO HAVE PLUME RISE CALCULATED
?
0
ENTER PHYSICAL STACK HEIGHT (M)
?
30
ENTER STACK GAS TEMPERATURE (DEG K)
?
350
ENTER VOLUME FLOW (M**3/SEC) IF KNOWN, OR ZERO (0) IF NOT KNOWN
?
0
ENTER STACK GAS VELOCITY (M/SEC)
?
20
ENTER STACK DIAMETER (M)
?
0.6
ENTER AMBIENT AIR TEMPERATURE (DEG K), OR ZERO (0) TO USE DEFAULT
VALUE OF 293
?
0
ENTER STABILITY CLASS (1-6)
?
3
ENTER WIND SPEED (M/SEC)
?
4
ENTER MIXING HEIGHT (M)
?
700
```

DOWNWIND CONCENTRATIONS FOR SPECIFIC DISTANCES
DBT43 - JUNE 1973 VERSION, D. B. TURNER

TEST OF PTDIS 7/5/73

* * * SOURCE CONDITIONS * * *

SOURCE STRENGTH (G/SEC) = 287.0
PHYSICAL STACK HEIGHT (M) = 30.0
STACK GAS TEMPERATURE (DEG K) = 350.0
STACK GAS VELOCITY (M/SEC) = 20.0
STACK DIAMETER (M) = 0.6
VOLUME FLOW (M**3/SEC) = 5.7

* * * METEOROLOGICAL CONDITIONS * * *

AMBIENT AIR TEMPERATURE (DEG K) = 293.0
STABILITY CLASS = 3
WIND SPEED (M/SEC) = 4.0
HEIGHT OF MIXING LAYER (M) = 700.0

FINAL EFFECTIVE HEIGHT OF EMISSION (M) = 41.8
DISTANCE TO FINAL EFFECTIVE HEIGHT (KM) = 0.095

DISTANCE (KM)	HEIGHT (M)	CONCENTRATION (G/CU M)	SIGY (M)	SIGZ (M)	CHI*U/Q (SEC/M**3)
0.100	41.8	3.41E-08	12.46	7.44	4.75E-10
0.200	41.8	8.10E-04	23.62	14.03	1.13E-05
0.300	41.8	3.95E-03	34.29	20.33	5.50E-05
0.400	41.8	5.54E-03	44.65	26.45	7.72E-05
0.452	41.8	5.69E-03	49.94	29.57	7.93E-05
0.500	41.8	5.60E-03	54.77	32.43	7.80E-05
0.600	41.8	5.08E-03	64.71	38.32	7.08E-05
0.700	41.8	4.43E-03	74.49	44.12	6.18E-05
0.800	41.8	3.83E-03	84.14	49.85	5.34E-05
0.900	41.8	3.31E-03	93.68	55.52	4.61E-05
1.000	41.8	2.87E-03	103.11	61.14	4.00E-05
2.000	41.8	9.59E-04	193.45	115.26	1.34E-05
3.000	41.8	4.75E-04	279.00	167.01	6.62E-06
5.000	41.8	1.92E-04	441.64	266.47	2.67E-06
7.000	41.8	1.05E-04	596.81	362.43	1.46E-06
10.000	41.8	5.76E-05	820.13	502.32	8.03E-07
15.000	41.8	3.51E-05	1175.00	727.85	4.90E-07
20.000	41.8	2.70E-05	1514.57	946.93	3.76E-07
30.000	41.8	1.89E-05	2161.94	1372.09	2.64E-07
50.000	41.8	1.21E-05	3373.06	2189.25	1.69E-07
70.000	41.8	9.07E-06	4510.52	2978.18	1.26E-07
100.000	41.8	6.68E-06	6123.50	4126.98	9.31E-08

RATIO IS THE HALF-WIDTH OF THE ISOPLETH COMPARED TO THE HALF-WIDTH OF A SECTOR OF 22.5 DEGREES AT THIS DISTANCE.

	ISOPLETH VALUES (GRAMS PER CUBIC METER)							
	0.10000E-02		0.20000E-03		0.10000E-03			
DISTANCE (KM)	HALF-WIDTH (M)	RATIO	HALF-WIDTH (M)	RATIO	HALF-WIDTH (M)	RATIO	HALF-WIDTH (M)	RATIO
0.100	0.	0.0	0.	0.0	0.	0.0		
0.200	0.	0.0	40.	1.006	49.	1.227		
0.300	57.	0.961	84.	1.412	93.	1.567		
0.400	83.	1.045	116.	1.453	127.	1.597		
0.452	94.	1.042	130.	1.443	142.	1.585		
0.500	102.	1.028	142.	1.427	156.	1.568		
0.600	117.	0.982	165.	1.384	182.	1.524		
0.700	129.	0.927	186.	1.336	206.	1.477		
0.800	138.	0.870	205.	1.288	228.	1.431		
0.900	145.	0.813	222.	1.243	248.	1.387		
1.000	150.	0.755	238.	1.199	268.	1.346		
2.000	0.	0.0	343.	0.863	412.	1.036		
3.000	0.	0.0	367.	0.616	493.	0.827		
5.000	0.	0.0	0.	0.0	504.	0.508		
7.000	0.	0.0	0.	0.0	187.	0.135		
10.000	0.	0.0	0.	0.0	0.	0.0		
15.000	0.	0.0	0.	0.0	0.	0.0		
20.000	0.	0.0	0.	0.0	0.	0.0		
30.000	0.	0.0	0.	0.0	0.	0.0		
50.000	0.	0.0	0.	0.0	0.	0.0		
70.000	0.	0.0	0.	0.0	0.	0.0		
100.000	0.	0.0	0.	0.0	0.	0.0		

ENTER "DISTANCE" OR "SOURCE" OR "METEOROLOGY" OR "END"
?
end
READY

Users' Guide to PTMTP (The Interactive Version of DBT 51)

Program Abstract

PTMTP produces hourly concentrations at up to 30 receptors whose locations are specified from up to 25 point sources. A Gaussian plume model is used. Inputs to the program consist of the number of sources to be considered, and for each source the emission rate, physical height, stack gas temperature, volume flow, or stack gas velocity and diameter, the location, in coordinates. The number of receptors, the coordinates of each and the height above ground of each receptor are also required. Concentrations for a number of hours up to 24 can be estimated, and an average concentration over this time period is calculated. For each hour the meteorological information required is: wind direction, wind speed, stability class, mixing height, and ambient air temperature.

The assumptions that are made in this model follow: Meteorological conditions are steady-state for each hour and a Gaussian plume model is applicable to determine ground level concentrations. Computations can be performed according to the "Workbook of Atmospheric Dispersion Estimates." The dispersion parameter values used for the horizontal dispersion coefficient, sigma y, and the vertical dispersion coefficient, sigma z, are those given in Figures 3-2 and 3-3 of the Workbook. The sources and receptors exist in either flat or gently rolling terrain, and the stacks are tall enough to be free from building turbulence so that no aerodynamic downwash occurs. The wind speed and wind direction apply from the shortest to the tallest plume height. No wind direction shear or wind speed shear occurs. The given stability exists from ground-level to well above the top of the plume.

Calculations for each hour are made by considering each source-receptor pair. Plume rise is calculated according to Briggs' plume rise estimates. For each source-receptor pair, the downwind and crosswind distances are determined. If the downwind distance is closer than the distance to final rise, the plume rise for this distance is calculated. The concentration from this source upon this receptor is determined using these distances by the Gaussian model.

The use of the interactive version of the program is relatively straightforward. First, an alphanumeric title to identify the output is entered. Next, the number of sources to be considered is given. The source strength, physical height, stack gas temperature, and volume flow is entered for each stack. If the volume flow is not known the stack gas velocity and diameter are required. The coordinates based on a coordinate system having units of one kilometer are required for each source. Next, the number of receptors to be processed, the coordinates of each and the height above ground for each are entered. The meteorological information includes the number of hours to be averaged up to 24, the wind direction, wind speed, stability class, mixing height, and ambient air temperature are entered for each hour. An option exists to print the partial concentrations, that is, the concentration from each source at each receptor. Also, an option exists to print the hourly concentrations.

The output is quite simple, consisting of title followed by input information on the sources, receptors, and meteorology. This is followed by hour by hour partial concentrations if desired and total concentrations. If partial concentrations are printed the final plume height for that hour for each source is also printed. Then average concentrations for the time period are printed including partial concentrations if desired. When the output is complete, the user is offered the option of ending the run or entering at 3 different points. He may go back to enter new sources or he may keep the same sources and enter new receptors or he may keep both the same sources and receptors and enter only different meteorological conditions.

```
ptmtp


* * *  N O T I C E  * * *
  USE OF THIS MODEL PRIOR TO JUNE 7, 1973 MAY HAVE PRODUCED
ERRONEOUS RESULTS IF ANY RECEPTORS WERE CLOSER TO SOURCES
THAN THE DISTANCE TO FINAL PLUME RISE.


ENTER ALPHANUMERIC TITLE (UP TO 64 CHARACTERS)
?
test of ptmtp 7/5/73
ENTER NUMBER OF SOURCES TO BE CONSIDERED. MAX 25
?
4
ENTER SOURCE STRENGTH (G/SEC) FOR EACH STACK
?
287,287,287,287
ENTER PHYSICAL HEIGHT (M) OF EACH STACK
?
30,30,30,30
ENTER GAS TEMPERATURE (DEG K) OF EACH STACK
?
4*350
IS VOLUME FLOW KNOWN FOR EACH STACK?  YES OR NO
?
no
ENTER GAS VELOCITY (M/SEC) FOR EACH STACK
?
4*20
ENTER DIAMETER (M) OF EACH STACK
?
4*0.6
ENTER COORDINATES (KM) OF EACH STACK.  ORDERED PAIRS
?
1.,0.,  1.05,0.,  1.10,0.,  1.15,0.
```

```
ENTER NUMBER OF RECEPTORS TO BE PROCESSED. MAX 30
?
14
ENTER COORDINATES (KM) OF EACH RECEPTOR.  ORDERED PAIRS
?
0.8,0.,  1.02,0.,  1.07,0.,  1.12,0.,  1.17,0.,  1.2,0.,
?
1.3,0.,  1.4,0.,  1.5,0.,  1.6,0.,  1.7,0.,  1.8,0.,
?
1.9,0.,  2.0,0.,
ENTER HEIGHT (M) ABOVE GROUND FOR EACH RECEPTOR
?
14*0.
ENTER NUMBER OF HOURS TO BE AVERAGED.  MAX 24
?
3
ENTER WIND DIRECTION (DEG) FOR EACH HOUR
?
265,270,275
ENTER WIND SPEED (M/SEC) FOR EACH HOUR
?
4,4,4
ENTER STABILITY CLASS FOR EACH HOUR
?
3*3
ENTER MIXING HEIGHT (M) FOR EACH HOUR
?
3*700
ENTER AMBIENT AIR TEMPERATURE (DEG K) FOR EACH HOUR
?
3*293
DO YOU WANT PARTIAL CONCENTRATIONS PRINTED? YES OR NO
?
yes
DO YOU WANT HOURLY CONCENTRATIONS PRINTED? YES OR NO
?
yes
```

TEST OF PTMTP 7/5/73

MULTIPLE SOURCE MODEL DBT51, JUNE 1973 VERSION

* * * S O U R C E S * * *

NO	Q (G/SEC)	HP (M)	TS (DEG K)	VS (M/SEC)	D (M)	VF (M**3/SEC)	R (KM)	S (KM)
1	287.0	30.0	350.0	20.0	0.6	5.7	1.000	0.0
2	287.0	30.0	350.0	20.0	0.6	5.7	1.050	0.0
3	287.0	30.0	350.0	20.0	0.6	5.7	1.100	0.0
4	287.0	30.0	350.0	20.0	0.6	5.7	1.150	0.0

* * * R E C E P T O R S * * *

NO	RREC (KM)	SREC (KM)	Z (M)
1	0.800	0.0	0.0
2	1.020	0.0	0.0
3	1.070	0.0	0.0
4	1.120	0.0	0.0
5	1.170	0.0	0.0
6	1.200	0.0	0.0
7	1.300	0.0	0.0
8	1.400	0.0	0.0
9	1.500	0.0	0.0
10	1.600	0.0	0.0
11	1.700	0.0	0.0
12	1.800	0.0	0.0
13	1.900	0.0	0.0
14	2.000	0.0	0.0

* * * M E T E O R O L O G Y * * *

NO	THETA (DEG)	U (M/SEC)	KST	HL (M)	T (DEG K)
1	265.0	4.0	3	700.	293.
2	270.0	4.0	3	700.	293.
3	275.0	4.0	3	700.	293.

HOUR # 1
* * * R E C E P T O R N U M B E R * * *

S	EFFHT	1	2	3	4	5	6
		PARTIAL CONCENTRATIONS (G/M**3)					
1	42.	0.0	0.0	4.650E-13	1.554E-06	1.733E-04	6.014E-04
2	42.	0.0	0.0	0.0	4.650E-13	1.554E-06	4.653E-05
3	42.	0.0	0.0	0.0	0.0	4.650E-13	2.405E-08
4	42.	0.0	0.0	0.0	0.0	0.0	8.150E-21
		TOTAL CONCENTRATION (G/M**3)					
		0.0	0.0	4.650E-13	1.554E-06	1.749E-04	6.480E-04

HOUR # 1
* * * R E C E P T O R N U M B E R * * *

S	EFFHT	7	8	9	10	11	12
		PARTIAL CONCENTRATIONS (G/M**3)					
1	42.	2.925E-03	4.072E-03	4.080E-03	3.669E-03	3.179E-03	2.726E-03
2	42.	1.772E-03	3.695E-03	4.164E-03	3.898E-03	3.424E-03	2.945E-03
3	42.	6.014E-04	2.925E-03	4.072E-03	4.080E-03	3.669E-03	3.179E-03
4	42.	4.653E-05	1.772E-03	3.695E-03	4.164E-03	3.898E-03	3.424E-03
		TOTAL CONCENTRATION (G/M**3)					
		5.344E-03	1.246E-02	1.601E-02	1.581E-02	1.417E-02	1.227E-02

HOUR # 1
* * * R E C E P T O R N U M B E R * * *

S	EFFHT	13	14
		PARTIAL CONCENTRATIONS (G/M**3)	
1	42.	2.337E-03	2.014E-03
2	42.	2.523E-03	2.168E-03
3	42.	2.726E-03	2.337E-03
4	42.	2.945E-03	2.523E-03
		TOTAL CONCENTRATION (G/M**3)	
		1.053E-02	9.043E-03

HOUR # 2
* * * R E C E P T O R N U M B E R * * *

S	EFFHT	1	2	3	4	5	6
		PARTIAL CONCENTRATIONS (G/M**3)					
1	42.	0.0	0.0	6.813E-13	2.148E-06	2.342E-04	8.096E-04
2	42.	0.0	0.0	0.0	6.813E-13	2.148E-06	6.322E-05
3	42.	0.0	0.0	0.0	0.0	6.813E-13	3.407E-08
4	42.	0.0	0.0	0.0	0.0	0.0	1.324E-20
		TOTAL CONCENTRATION (G/M**3)					
		0.0	0.0	6.813E-13	2.148E-06	2.364E-04	8.728E-04

HOUR # 2
* * * R E C E P T O R N U M B E R * * *

S	EFFHT	7	8	9	10	11	12
		PARTIAL CONCENTRATIONS (G/M**3)					
1	42.	3.946E-03	5.538E-03	5.598E-03	5.077E-03	4.434E-03	3.829E-03
2	42.	2.384E-03	5.004E-03	5.689E-03	5.371E-03	4.756E-03	4.123E-03
3	42.	8.096E-04	3.946E-03	5.538E-03	5.598E-03	5.077E-03	4.434E-03
4	42.	6.323E-05	2.384E-03	5.004E-03	5.689E-03	5.371E-03	4.756E-03
		TOTAL CONCENTRATION (G/M**3)					
		7.203E-03	1.687E-02	2.183E-02	2.173E-02	1.964E-02	1.714E-02

HOUR # 2
* * * R E C E P T O R N U M B E R * * *

S	EFFHT	13	14
		PARTIAL CONCENTRATIONS (G/M**3)	
1	42.	3.306E-03	2.867E-03
2	42.	3.557E-03	3.077E-03
3	42.	3.829E-03	3.306E-03
4	42.	4.123E-03	3.557E-03
		TOTAL CONCENTRATION (G/M**3)	
		1.482E-02	1.281E-02

HOUR # 3
* * * R E C E P T O R N U M B E R * * *

S	EFFHT	1	2	3	4	5	6
		PARTIAL CONCENTRATIONS (G/M**3)					
1	42.	0.0	0.0	4.637E-13	1.550E-06	1.729E-04	6.001E-04
2	42.	0.0	0.0	0.0	4.637E-13	1.550E-06	4.642E-05
3	42.	0.0	0.0	0.0	0.0	4.637E-13	2.398E-08
4	42.	0.0	0.0	0.0	0.0	0.0	8.121E-21
		TOTAL CONCENTRATION (G/M**3)					
		0.0	0.0	4.637E-13	1.550E-06	1.745E-04	6.465E-04

HOUR # 3
* * * R E C E P T O R N U M B E R * * *

S	EFFHT	7	8	9	10	11	12
		PARTIAL CONCENTRATIONS (G/M**3)					
1	42.	2.918E-03	4.062E-03	4.070E-03	3.660E-03	3.171E-03	2.719E-03
2	42.	1.768E-03	3.686E-03	4.154E-03	3.888E-03	3.415E-03	2.937E-03
3	42.	6.001E-04	2.918E-03	4.062E-03	4.070E-03	3.660E-03	3.171E-03
4	42.	4.642E-05	1.768E-03	3.686E-03	4.154E-03	3.888E-03	3.415E-03
		TOTAL CONCENTRATION (G/M**3)					
		5.332E-03	1.243E-02	1.597E-02	1.577E-02	1.413E-02	1.224E-02

HOUR # 3
* * * R E C E P T O R N U M B E R * * *

S	EFFHT	13	14
		PARTIAL CONCENTRATIONS (G/M**3)	
1	42.	2.331E-03	2.009E-03
2	42.	2.517E-03	2.162E-03
3	42.	2.719E-03	2.331E-03
4	42.	2.937E-03	2.517E-03
		TOTAL CONCENTRATION (G/M**3)	
		1.050E-02	9.019E-03

```
AVERAGE CONCENTRATIONS FOR  3 HOURS.
* * * R E C E P T O R   N U M B E R * * *
              1          2          3          4          5          6
 S           PARTIAL CONCENTRATIONS (G/M**3)

 1         0.0        0.0        5.367E-13  1.751E-06  1.935E-04  6.704E-04
 2         0.0        0.0        0.0        5.367E-13  1.751E-06  5.206E-05
 3         0.0        0.0        0.0        0.0        5.367E-13  2.737E-08
 4         0.0        0.0        0.0        0.0        0.0        9.836E-21
            TOTAL CONCENTRATION (G/M**3)

           0.0        0.0        5.367E-13  1.751E-06  1.952E-04  7.224E-04
* * * R E C E P T O R   N U M B E R * * *
              7          8          9         10         11         12
 S           PARTIAL CONCENTRATIONS (G/M**3)

 1         3.263E-03  4.557E-03  4.582E-03  4.135E-03  3.595E-03  3.091E-03
 2         1.975E-03  4.128E-03  4.669E-03  4.386E-03  3.865E-03  3.335E-03
 3         6.704E-04  3.263E-03  4.557E-03  4.582E-03  4.135E-03  3.595E-03
 4         5.206E-05  1.975E-03  4.128E-03  4.669E-03  4.386E-03  3.865E-03
            TOTAL CONCENTRATION (G/M**3)

           5.960E-03  1.392E-02  1.794E-02  1.777E-02  1.598E-02  1.389E-02
* * * R E C E P T O R   N U M B E R * * *
             13         14
 S           PARTIAL CONCENTRATIONS (G/M**3)

 1         2.658E-03  2.297E-03
 2         2.866E-03  2.469E-03
 3         3.091E-03  2.658E-03
 4         3.335E-03  2.866E-03
            TOTAL CONCENTRATION (G/M**3)

           1.195E-02  1.029E-02

ENTER "SOURCES" OR "RECEPTORS" OR "METEOROLOGY" OR "END"
?
end
READY
logoff
```

REFERENCES

Briggs, Gary A., 1971: Some recent analyses of plume rise observation. 1029-1032 in Proceedings of the Second International Clean Air Congress, edited by H. M. Englund and W. T. Berry. Academic Press, New York.

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